CLAIMS

What Is Claimed Is:

1. A method of separation comprising the steps of:
    a) introducing an impurity-containing fluid stream into a heating zone,
    b) elevating said heating zone to a first temperature, wherein substantially all impurities present in said impurity-containing fluid stream are prevented from undergoing a phase change,
    c) introducing said impurity-containing fluid stream into a cooling zone, and
    d) reducing said cooling zone to a second temperature, wherein substantially all impurities present in said impurity-containing fluid stream have undergone a first phase change.
2. The method of claim 1, wherein said first phase change is freezing or condensing.
3. The method of claim 2, wherein said first phase change is freezing.
4. A method of separation comprising the steps of:
    a) introducing an impurity-containing gas stream into a heating zone,
    b) elevating said heating zone to a first temperature, wherein substantially all impurities present in said impurity-containing gas stream are prevented from undergoing a phase change,
    c) introducing said impurity-containing gas stream into a cooling zone, and
    d) reducing said cooling zone to a second temperature, wherein substantially all impurities present in said impurity-containing gas stream are solidified.
5. The method of claim 4, wherein said impurities are solidified onto said cooling zone.
6. The method of claim 4, wherein said heating zone contains a first heat exchanger.

7. The method of claim 4, wherein said cooling zone contains a second heat exchanger.

8. The method of claim 7, wherein said impurities are solidified on to the surface of said second heat exchanger.

9. A method of separating wax from a wax-containing feedstock comprising the steps of:

a) introducing a wax-containing gas stream into a heating zone, wherein said heating zone contains a first heat exchanger,

b) elevating said heating zone to a first temperature, wherein substantially all of the wax present in said wax-containing gas stream is prevented from undergoing a phase change,

c) introducing said wax-containing gas stream into a cooling zone, wherein said cooling zone contains a second heat exchanger, and

d) reducing said cooling zone to a second temperature, wherein substantially all of the wax present in said wax-containing gas stream is solidified onto the surface of said second heat exchanger.

10. The method of claim 9, wherein said wax consists of a high molecular weigh hydrocarbon.

11. The method of claim 10, wherein said high molecular weight hydrocarbon consists of C_{12} and higher.

12. The method of claim 10, wherein said wax-containing gas stream consists primarily of non-condensable air, nitrogen or argon.

13. The method of claim 10, wherein said first temperature is between about 150 °F and about 300 °F.

14. The method of claim 13, wherein said first temperature is about 250 °F.

15. The method of claim 10, wherein said second temperature is below ambient temperature.

16. The method of claim 10, wherein said cooling zone temperature is reduced by circulating a first fluid through said second heat exchanger.

17. The method of claim 16, wherein said first fluid is selected from the group consisting of liquid air, liquid nitrogen, liquid argon and liquid oxygen.

18. The method of claim 16, wherein said first fluid is water.

19. The method of claim 10, wherein said second temperature is between about – 321 °F and about 100 °F.

20. The method of claim 19, wherein said second temperature is between about 0 °F and about 40 °F.

21. The method of claim 15, wherein said ambient temperature is between about 0 °F and about 100 °F.

22. The method of claim 10, further comprising the step of:

    e) elevating said cooling zone to a third temperature, wherein substantially all of the wax present on the surface of said second heat exchanger is melted.

23. The method of claim 22, further comprising the step of:

    f) collecting said melted wax.

24. The method of claim 22 wherein said third temperature is between about 150 °F and about 300 °F.

25. The method of claim 24, wherein said third temperature is about 250 °F.

26. A method of separating wax from a waxy gas stream comprising the steps of:

a) introducing a wax-containing gas stream into a system comprising at least a first heating zone, a second heating zone, a first cooling zone, and a second cooling zone, wherein said first heating zone contains a first heat exchanger, said second heating zone contains a second heat exchanger, said first cooling zone contains a third heat exchanger, and said second cooling zone contains a fourth heat exchanger,

b) directing said wax-containing gas stream to said first heating zone,

c) elevating said first heating zone to a first temperature, wherein substantially all of the wax present in said wax-containing gas stream is prevented from undergoing a phase change,

d) directing said wax-containing gas stream to said first cooling zone,

e) reducing said first cooling zone to a second temperature, wherein substantially all of the wax present in said wax-containing gas stream is solidified onto the surface of said third heat exchanger, and

f) increasing said second cooling zone to a third temperature, wherein substantially all of the wax present on the surface of said fourth heat exchanger is melted.

27. The method of claim 26, further comprising the step of:

g) collecting said melted wax.

28. The method of claim 26, wherein steps e) and f) occur approximately concurrently.

29. The method of claim 26, wherein said first cooling zone and said second cooling zone further comprises at least one device for detecting the presence of said solidified wax on at least one of said third heat exchanger or said fourth heat exchanger.

30. The method of claim 29, wherein said detection device monitors the pressure drop experienced by said wax-containing gas as it passes through at least one of said first cooling zone or said second cooling zone.

31. The method of claim 26, wherein at least one of said first heat exchanger or said second heat exchanger further comprises an inlet and an outlet, and wherein said detection device monitors the change in temperature between said inlet and outlet experienced in at least one of said first heat exchanger or said second heat exchanger.

32. The method of claim 26, further comprising the steps of:

g) monitoring said detection device on said third heat exchanger and said fourth heat exchanger,

h) determining if either said third heat exchanger or said fourth heat exchanger is substantially covered with said solidified wax,

i) directing said wax-containing gas stream into either said first heating zone, if said fourth heat exchanger is substantially covered with said solidified wax, or to said second heating zone, if said third heat exchanger is substantially covered with said solidified wax, and

j) regenerating, either said second cooling zone, wherein substantially all of the wax present on the surface of said third heat exchanger is melted, if said wax-containing gas stream is directed into said first heating zone, or said first cooling zone, by increasing either said first cooling zone or said second cooling zone to a third temperature wherein substantially all of the wax present on the surface of said fourth heat exchanger is melted, if said wax-containing gas stream is directed into said second heating zone.

33. An apparatus for separating, comprising:

a) an inlet conduit,

b) a first heating zone fluidly connected to said inlet conduit,

c) a first cooling zone fluidly connected to said first heating zone, and

d) an outlet conduit fluidly connected to said first cooling zone.

34. The apparatus of claim 33, wherein said first heating zone contains a first heat exchanger.

35. The apparatus of claim 33, wherein said first cooling zone contains a second heat exchanger.

36. An apparatus for separating, comprising:

a) an inlet conduit

b) a first heating zone fluidly connected to said inlet conduit,

c) a second heating zone fluidly connected to said inlet conduit,

d) a first cooling zone fluidly connected to said first heating zone,

e) a second cooling zone fluidly connected to said second heating zone, and

f) an outlet conduit fluidly connected to said first cooling zone and said second cooling zone.

37. The apparatus of claim 36, wherein said first heating zone contains a first heat exchanger.

38. The apparatus of claim 36, wherein said second heating zone contains a second heat exchanger.

39. The apparatus of claim 36, wherein said first cooling zone contains a third heat exchanger.

40. The apparatus of claim 36, wherein said second cooling zone contains a fourth heat exchanger.

41. The apparatus of claim 38, wherein at least one of said third heat exchanger or said fourth heat exchangers further comprises a detection device for detecting the presence of solidified wax on said third or said fourth heat exchanger.

42. The apparatus of claim 39, wherein at least one of said third heat exchanger or said fourth heat exchangers further comprises a detection device for detecting the presence of solidified wax on said third or said fourth heat exchanger.